MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2015/2016

PPC0016 – PRE-CALCULUS

(All Sections / Groups)

9 MARCH 2016
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This examination paper consists of **5 pages** (including the cover page) with **4 questions only**.

2. Each question is worth **25 marks. Attempt ALL questions.**

3. Please write all your answers in the Answer Booklet provided. **Show all relevant steps** to obtain maximum marks.

Question 1 (25 marks)

(a) Find the real solution(s) for the following equations:

i. $\frac{6}{2x-3} = \frac{4}{x+5}$

[3 marks]

ii. $x^2 + 5x - \sqrt{x^2 + 5x} = 6$

[6 marks]

(b) Solve the following equation by completing the square.

$$4x^2 + 24x + 35 = 0$$

[5 marks]

(c) Write each of the following expressions in the standard form $a + bi$.

i. $3i^{18}(1 + i^{11})$

[3 marks]

ii. If $z = 5 + i$ and $= 4 - 5i$, evaluate $\overline{(z - w)} \cdot w$.

[4 marks]

(d) Solve the inequality $|-2x + 5| + 7 \leq 12$.

[4 marks]

Continued...

Question 2 (25 marks)

(a) Given the function $f(x) = \begin{cases} 2 - x & \text{if } x \leq 2 \\ |x| & \text{if } x > 2 \end{cases}$

i. Graph the function.

[3 marks]

ii. List the intercept(s).

[2 marks]

(b) Figure Q2 shows the graph of the function $\frac{1}{x^2}$. Use the graph transformation technique to sketch the rational function $2 - \frac{1}{(x+3)^2}$. Show all the transformation steps. Clearly label all the asymptotes of the graph.

[6 marks]

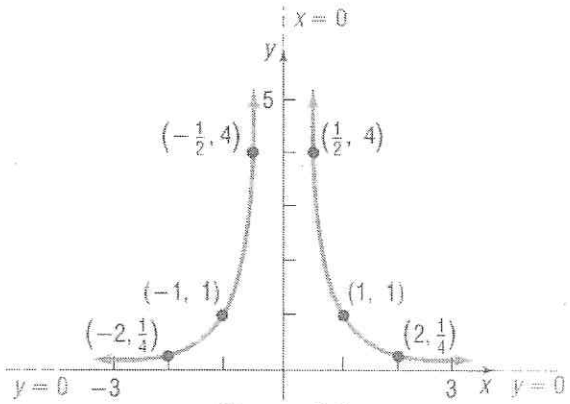

Figure Q2

(c) For the polynomial function $f(x) = x(x+1)(x-2)^2$.

i. Find its x- and y-intercept(s).

[2 marks]

ii. At each x-intercept, determine whether the graph crosses or touches the x-axis.

[3 marks]

iii. Determine the behavior of the graph near each x-intercept.

[3 marks]

iv. Determine the maximum number of turning points on the graph.

[1 mark]

v. Find the power function that the graph resembles for large values of $|x|$ (end behavior).

[2 marks]

vi. Sketch the graph of $f(x)$. Label all relevant points.

[3 marks]

Continued...

Question 3 (25 marks)

(a) Given the function $f(x) = 9x^4 + 26x^3 - 3x^2 + x - 3$.

i. Use the Factor Theorem to determine whether the function $f(x)$ has the factor $x + 3$.

[3 marks]

ii. Verify your answer in Q3(a)(i) using synthetic division.

[3 marks]

(b) Use long division method to find the quotient and remainder when $x^4 - 5x^2 - 36$ is divided by $x - 4$.

[6 marks]

(c) Show that the partial fraction decomposition of $\frac{6x^2-28x+23}{(x-2)^2(x-3)}$ can be expressed as $\frac{13}{x-2} + \frac{9}{(x-2)^2} + \frac{-7}{x-3}$.

[8 marks]

(d) List the potential roots of $f(x) = 6x^4 + 3x^3 - 4x^2 + 2$ using the Rational Root Theorem.

[5 marks]

Continued...

Question 4 (25 marks)

(a) Write the first four terms of the following sequence:

$$\{a_n\} = (-1)^{n+1} \cdot 5n$$

[2 marks]

(b) The 10^{th} term of an arithmetic sequence is -7, and the 29^{th} term is -79.

i. Find the first term and the common difference of the sequence.

[4 marks]

ii. Give a recursive formula for the sequence.

[1 mark]

iii. What is the sum of the first 100 terms of the sequence?

[3 marks]

(c) As Alice improves her algebra skills, she takes 0.7 times as long to complete each homework assignment as she took to complete the preceding assignment. Assume that she took 90 minutes to complete her first assignment. Answer the following questions and round your answer to the nearest minute.

i. Find how long it took her to complete the sixth assignment.

[3 marks]

ii. Find the total time she took to complete her first six homework assignments.

[3 marks]

(d) Use the Binomial Theorem to expand $(2x + 5)^4$.

[5 marks]

(e) Find the constant term in the expansion of $\left(2x - \frac{1}{x}\right)^{10}$.

[4 marks]

End of Paper